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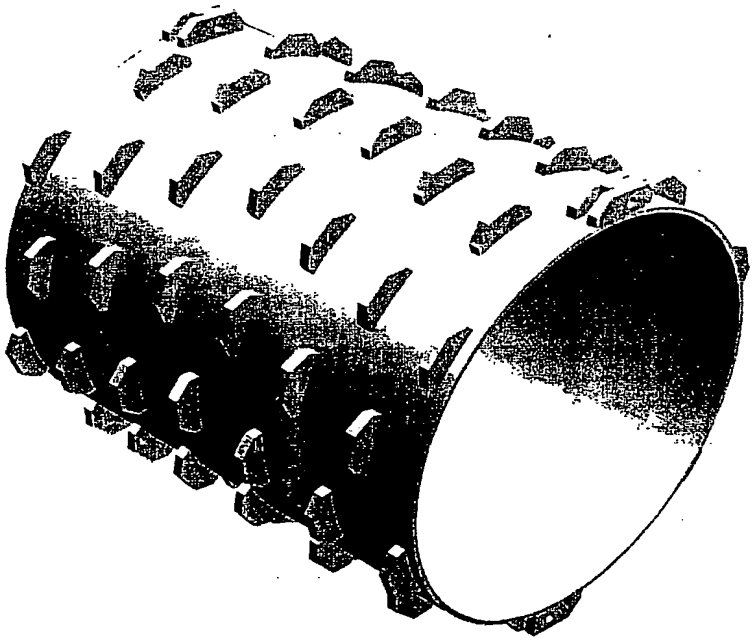
(54) Titre : CAME POUR ROULEAU VIBRANT
(54) Title: ROLLOR CAM



(57) Abrégé/Abstract:
On the smooth-drum of a vibratory roller, used in road construction for compacting gravel and soil, is to be fitted a steel shell. The shell is to be fabricated in two longitudinal half shells, for fitting on, and removing from the drum. To be welded on the shell are steel cams, for crumbling deteriorated pavement into fragments. Cams are to be circumferentially positioned around the shell uniformly, in a pattern to produce maximum fragments per drum revolution, and to drive fragments into underlying roadbed gravel.

Abstract

A short technical summary of my invention.

On the smooth-drum of a vibratory roller, used in road construction for compacting gravel and soil, is to be fitted a steel shell. The shell is to be fabricated in two longitudinal half-shells, for fitting on, and removing from the drum. To be welded on the shell are steel cams, for crumbling deteriorated pavement into fragments. Cams are to be circumferentially positioned around the shell uniformly, in a pattern to produce maximum fragments per drum revolution, and to drive fragments into underlying roadbed gravel.

Specification

This invention relates to a modification to a smooth-drum vibratory compacting roller, and to its use in a method of improving rural paved roads.

Compacting rural gravel roads prior to first paving, was unknown 40 years ago, at the start of greatest paving activity on rural roads. A paved but uncompacted gravel roadbed resting on sublayer soils of varying densities and permeabilities, and subject to the vibration and cumulative compacting effect of wheeled traffic, eventually settles at random within its gravel layers. Subsidence in the paved surface then develops, to be followed by varying degrees of pavement deterioration. Most paved rural roads show extensive pavement deterioration and repairs. Costs for reconstructing uncompacted, settled roadbeds, prohibitive in recent years, have prompted resort to several processes of roadsurface rehabilitation, prior to repaving. These processes give the appearance of long-term improvement, but fail to compact the roadbed into its sublayers to produce maximum density in the reconsolidated roadbase structure.

My inventive idea embodies a method to reconsolidate an uncompacted gravel roadbed and its deteriorated pavement, by intensive compacting effort, from the surface downward. A vibratory smooth-drum roller fitted with a shell on which cams are welded, is to crumble rutted and deteriorated pavement in place, and to drive pavement fragments into its roadbed gravel. The main component of asphaltic concrete pavement is crushed gravel; therefore deteriorated pavement, crumbled into fragments, is wholly compatible with roadbed gravel. A smooth-drum vibratory roller then is to compact the mix of fragments and roadbed gravel intensively, to drive the compacted mix into consolidation with the roadbed's sublayer soils. Such intensive compacting effort is to develop resistance in sublayer soils equivalent to the load imposed by the mix of pavement fragments and roadbed gravel displaced into sublayers, and by the weight of gravel to be added to restore zones of displacement in the road surface. The reconsolidated roadbase is to reach a stage of 'refusal' to continued compacting effort as the compacting roller makes negligible impression in the road surface. Density of the roadbase is to be measured by geotechnical instruments.The condition of 'refusal' to continued compacting effort, in a reconsolidated roadbase, is essential to prevent settling of the roadbase, and eventual subsidence in its layer of new pavement.

Description

In drawings which illustrate embodiments of the invention, Figure 1 is a view in perspective of a steel shell with cams welded to it; Figure 2 is a view in perspective of a smooth-drum vibratory roller; Figure 3 is a view in perspective of one half-shell, showing double and single locking cams; Figure 4 is a view in perspective of two shells locked (on one side) by a steel pin through the double and single cams; Figure 5 is a view in plan, elevation and perspective of a cam; Figure 6 is a view in perspective of a padfoot vibratory roller; Figure 7 is a photograph of a vibratory soil-compactor crumbling deteriorated pavement; Figure 8 is a photographic view of pavement fragments; Figure 9 is a photographic view of pavement fragments in a mix with uncompacted roadbed gravel: Figure 10 is a photographic view of a road compacted to a stage approaching 'refusal'. Figure 11 is a cross-section A of pavement on uncompacted roadbed gravel resting on sublayer soils, and a cross-section B, of pavement fragments and roadbed gravel reconsolidated in sublayer soils.

The steel shell, 'rollor cam' (Fig.1), comprises a modification to a smooth-drum vibratory roller (Fig.2), on which the shell in two halves (Fig.3) may be mounted. Each half-shell is to be locked on the smooth-drum to the other half-shell (Fig.4), by four sets of single cams 1 and double cams 2, each set to be locked by a removable steel pin 3. In passing over road pavement (Fig.11)A,8 and roadbed gravel 9 resting on sublayer soils 10 of varying densities and permeabilities, the 'rollor cam' (Fig.1) in non-vibratory mode is to crumble pavement (Fig.11A)8 into fragments. In vibratory mode, the 'rollor cam' (Fig.1) is to drive fragments into a mix with uncompacted roadbed gravel 9. One day later, on the section of pavement previously crumbled into fragments, a smooth-drum roller (Fig.2) in vibratory mode is to compact the mix of pavement fragments and roadbed gravel 9, and to drive the mix to 'refusal', in consolidation with sublayer soils (Fig. 11B)11. On the reconsolidated roadbase (Fig.11B), crushed gravel 12 is to be spread, graded evenly, and compacted, preparatory to repaving.

Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

Intensive compaction by 'rollor cam' is to produce a denser, more durable roadbase, than by current processes of roadbed reconstruction and roadsurface rehabilitation, as listed below:

reconstruction - reconstruction of roadbed;
rehabilitation - gravel overlay (covering-over of pavement);
rehabilitation - asphalt mix overlay on deteriorated pavement (recapping);
rehabilitation - 'mulching' pavement into roadbed gravel;
rehabilitation - grinding pavement in place and repaving ('mill-and-fill').

The reconsolidation method raises a prospect of prolonging pavement service life beyond the unmet technical goal of 20 years.

Three projects between 1984 and 1991, without benefit of 'rollor cam', demonstrated the reconsolidation procedure as a low-cost, rapid and technically proven method for improving rural roads. Pavements on reconsolidated roadbases are outlasting those on roadbeds reworked by other processes.

The third project, above, in 1991 recorded a lowest cost of $27,950 for 776 metres ($36,000/km) versus $150,000/km, the construction industry minimum for roadbed reconstruction.

A 'rollor cam' contact area (Fig.5) of one cam on pavement to be crumbled, is 1" x 3" square inches 6, or 1/6 of the contact area of a padfoot roller 'foot' (Fig.6) of 3" x 6" square inches 7, and therefore has 6 times the loading or crumbling effort of a padfoot roller 'foot'on pavement.

Environmentally, the reconsolidation method can conserve gravel stocks by re-using, rather than replacing roadbed gravel, by reducing machine fuel use and exhaust emissions, and by eliminating the wasting of excavated road materials with its asphalt content, from leaching into groundwater.

A road reconsolidation project site is accessible and traversable by emergency and other vehicles, during and after work hours, ar reduced speeds.

The method of reconsolidating may be considered as a dynamic 'preload' of a roadbed with its sublayer soils, by mechanically displacing pavement fragments and roadbed gravel therein. The method may be likened to a static 'preload' of a building site, on which granular materials are spread in depth, to compact site sublayers over time.

Fig. 1

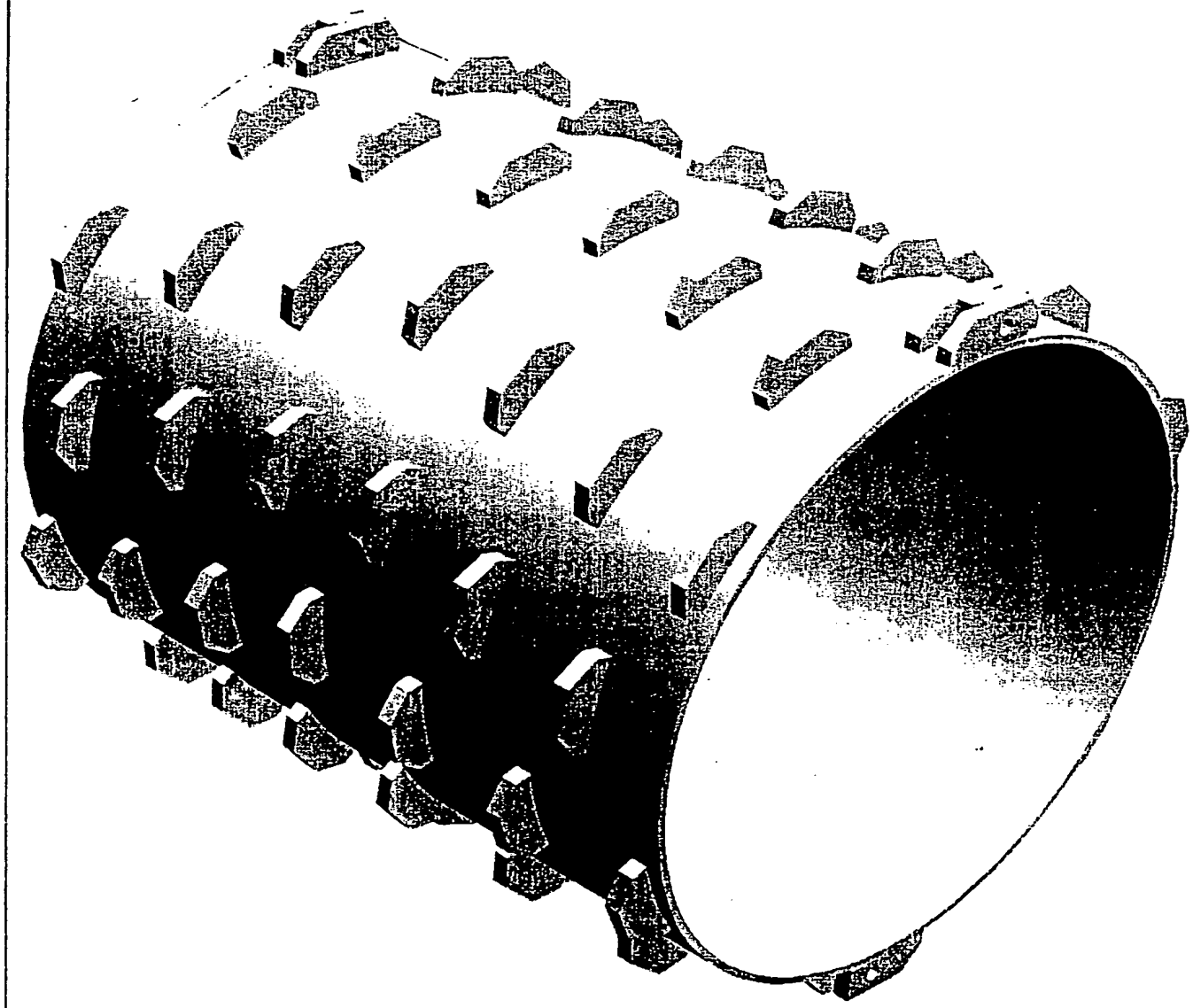


Fig. 2

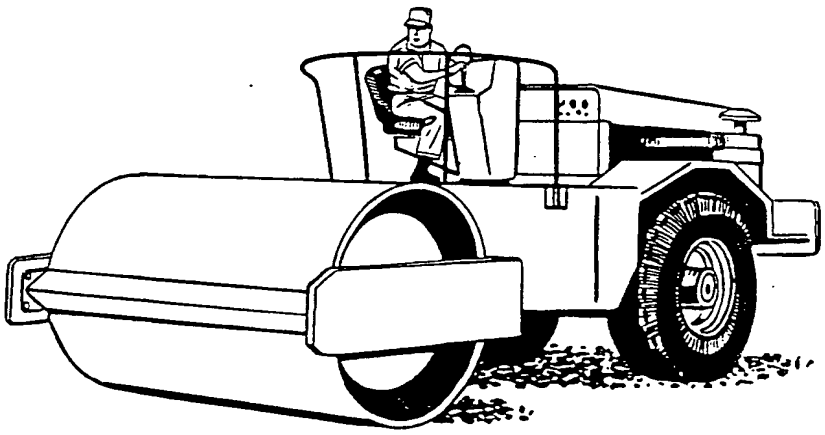


Fig. 3

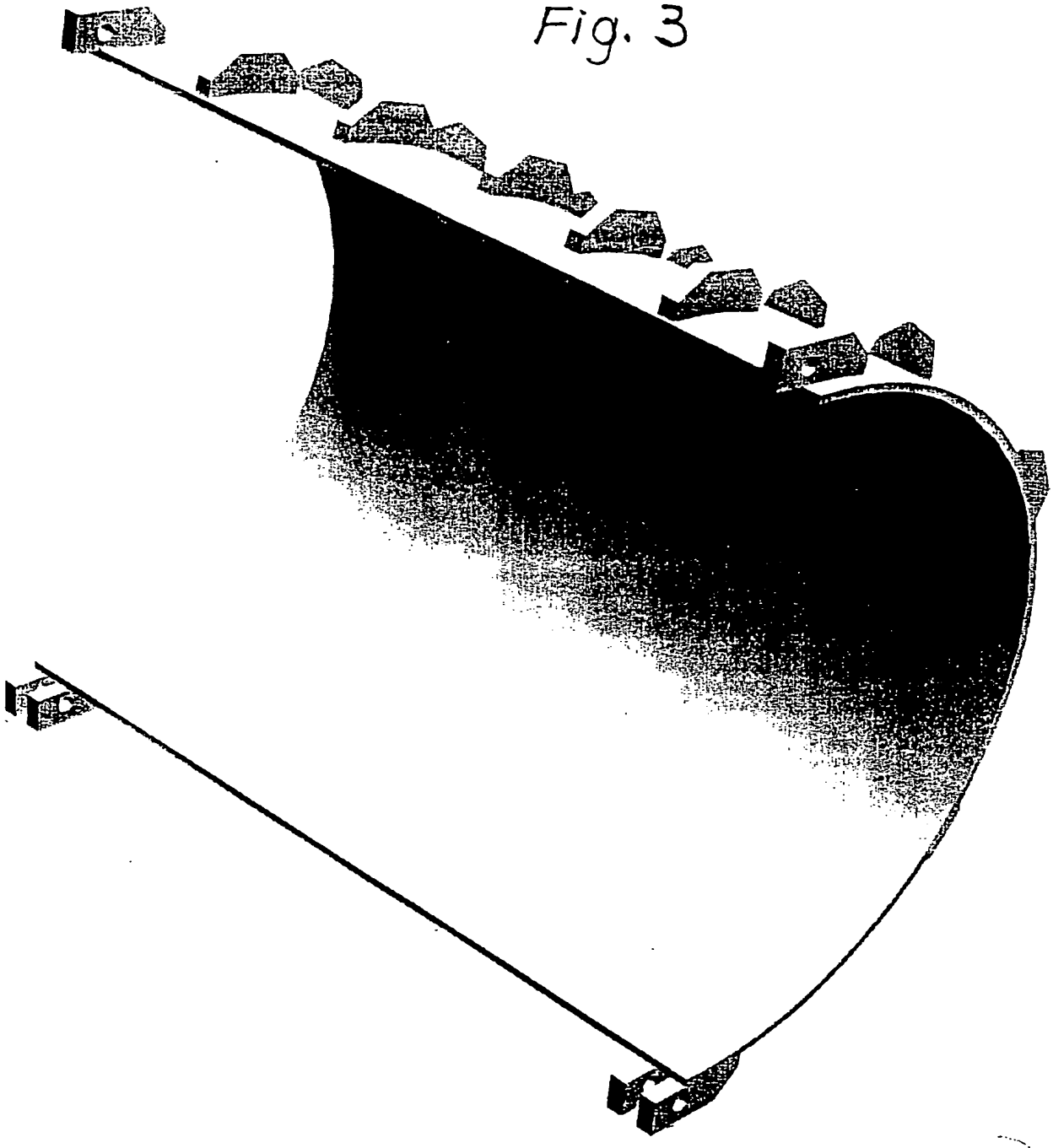


Fig. 4

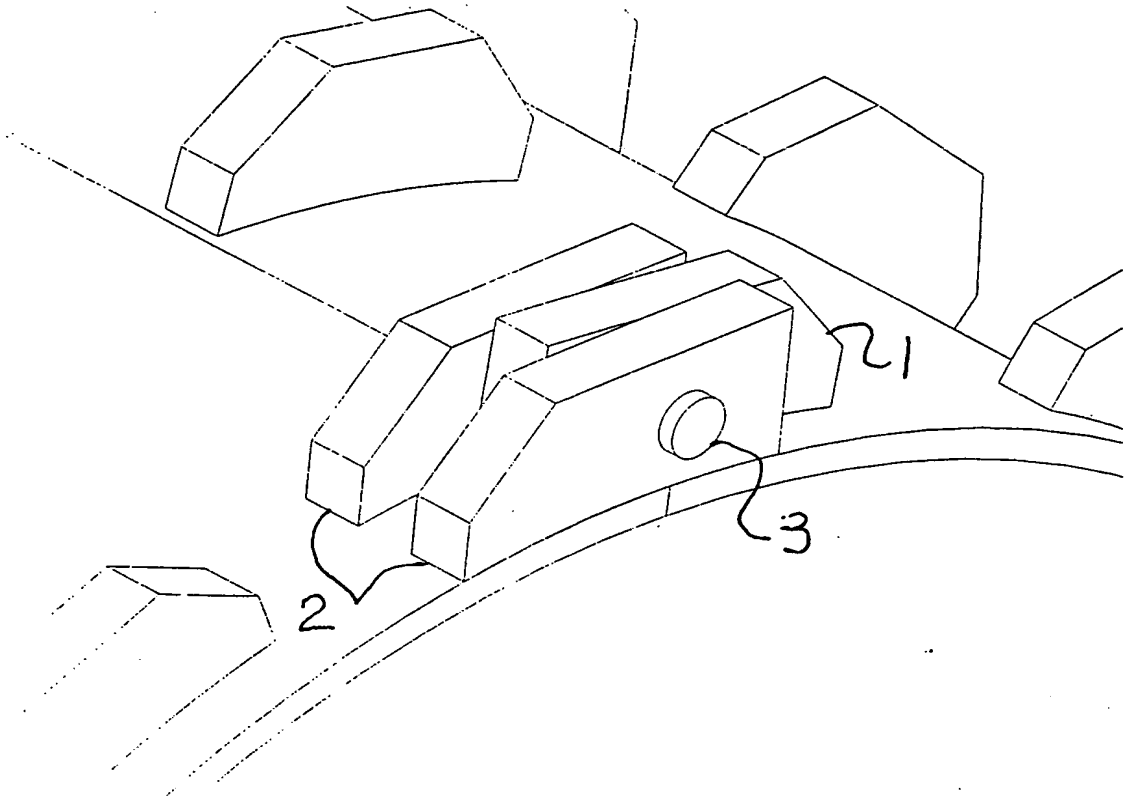
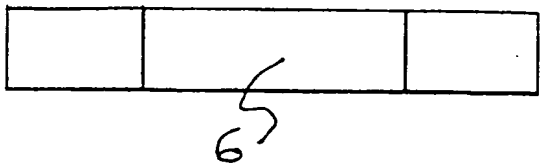
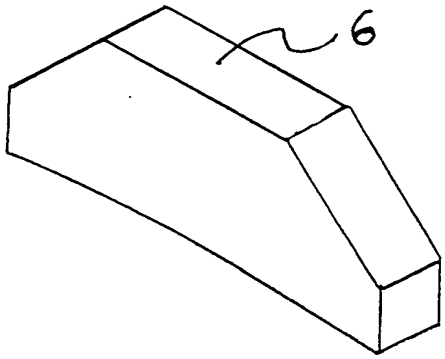


Fig. 5





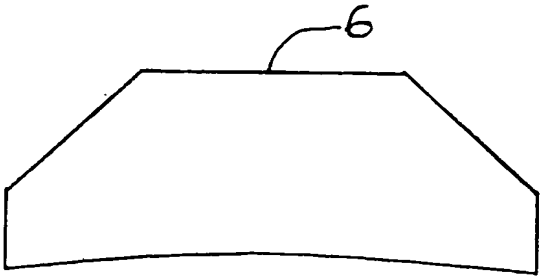


Fig. 6

Fig. 7

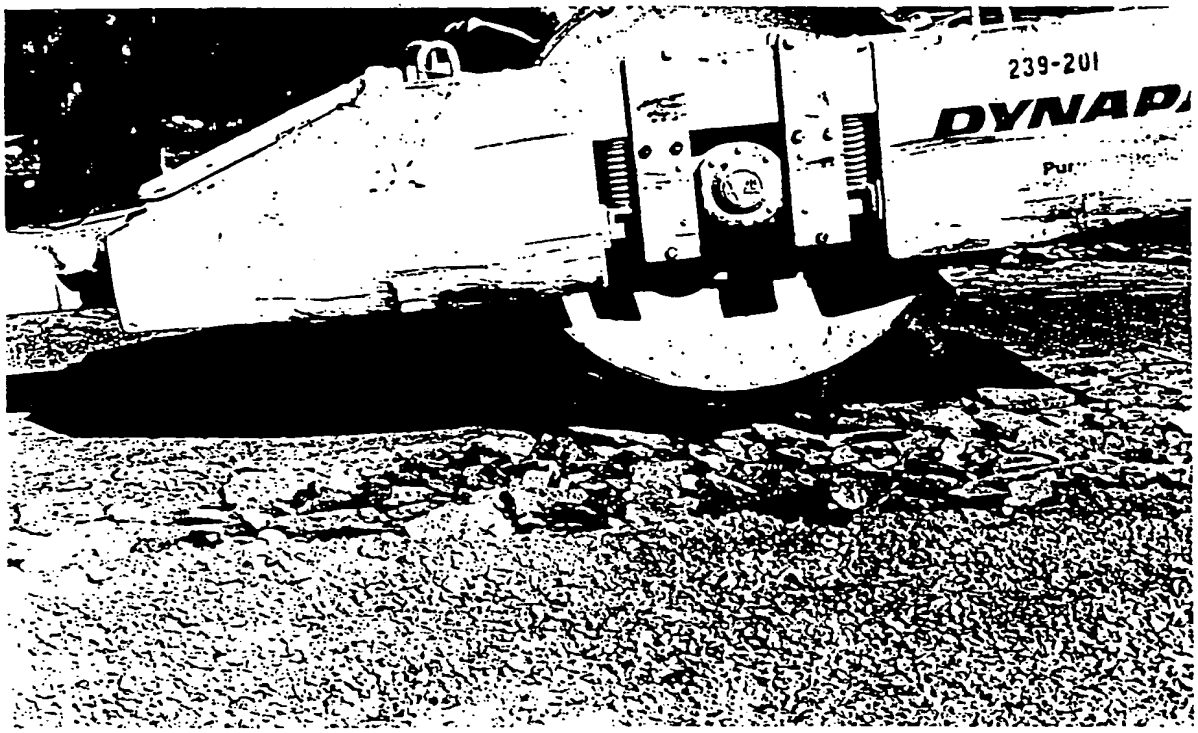


Fig. 8

Fig. 9

Fig. 10

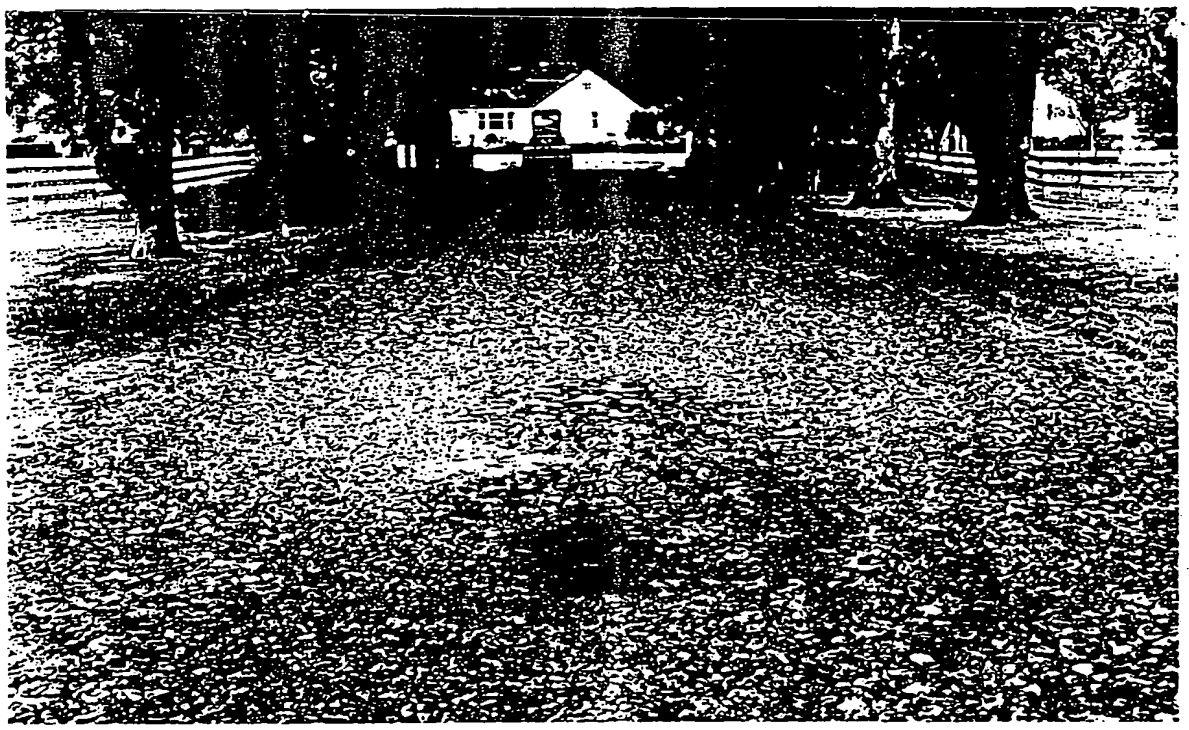


Fig. 11